In particular the phenomenon "*the neck*," in the transits of *Mercury* and *Venus*, would be an obvious consequence of irradiation, which would diminish the planet's disc and enlarge that of the sun, except at the small portion of the circumferences in contact, when the absence of *both* irradiations would produce a "neck."

Both theory and experiment shew that a small dark disc would have for its image a diminished disc with a bright internal concentric ring, which, if the disc be very small, will be contracted to a central bright point. This seems to agree with the appearance noticed by several observers in the transit of a white spot on the centre of the planet. On a former occasion, however, Professor Moll and others saw such a spot *excentrical*. The projection of a star on the *bright* limb of the moon would also be an effect of irradiation, which would cause the disc of the moon simply to overlap the star.

Lastly, the author suggests a method for obtaining *measures of the amount of irradiation under any given light*, by placing a card, cut as before, at the focus of a lens, opposite to the object-glass of a telescope, and attached to it by a short tube; when the enlargement of the image of the card, illumined by the light from any source, can be subjected to the exact measurement of the micrometer of the telescope.

On a New Method of Observing Transits. By A. D. Bache, Esq., Director of the American Coast Survey.

"Permit me to invite your attention, and that of the members of the Royal Astronomical Society, to a brief abstract of an official report made to me on the 15th inst. by Mr. Sears C. Walker, one of the assistants of the U. S. Coast Survey. It relates to the printing, by the use of an electro-magnetic clock, in connexion with Morse's telegraph register, of the actual dates of any celestial phenomena, which are ordinarily made the subject of observation by astronomers.

"The electro-magnetic clock of Mr. Wheatston is described in the *Proceedings* of the Royal Astronomical Society for Nov. 19th, 1841. Mr. Steinheil has described his in Schumacher's Astronomical *Jahrbuch* for 1844.

"Recently Prof. Bond and Dr. Locke have invented different processes, which are described in Mr. Walker's Report.

"Prof. Bond proposes to make circuit by the metallic contact of insulated portions of the pallet and escapement-wheel. Dr. Locke, like Mr. Wheatston, uses a metallic wheel on the arbor of the seconds' hand. This wheel has sixty teeth, each of which when horizontal strikes against a platinum lever or tilt-hammer, weighing two grains. The rising and falling of the hammer from a bed of platinum breaks and makes the galvanic circuit. The fulcrum of the tilt-hammer and the platinum bed rest severally on a small block of wood.

"The object of all these methods is to cause a delicate astronomical clock to make and break the galvanic circuit every second, without injury to the machinery or rate of the clock. The mode of action of such alternations on Morse's electro-magnetic telegraph register, as now in daily use in the United States, is the same for each of these methods.

"The *automatic clock register* thus formed consists of a graduated fillet of paper delivered pretty uniformly at the rate of an inch per second. The beginnings of minutes, and fives and tens of minutes, and of seconds, and fives and tens of seconds, are distinguished from each other by the lengths of the corresponding imprinted blank spaces. The printed second consists of an indented line of about nine-tenths of a second or less, and of a blank space for the remainder. The rate of the delivery of the paper is regulated by a centrifugal clock like those of the Munich equatoreals. An error of two seconds per minute in the rate of delivery causes only an average error of one-hundredth of a second in the register of a date.

"The printing of the date of any event not susceptible of automatic register, but dependent for our knowledge of its occurrence upon human sensations, is effected by tapping gently at this date on a *break circuit telegraph key*, so as to insert in the line of the *automatic clock register* a short blank space, whose beginning marks the instant of the tap. Should this blank space occur near that of the *automatic clock register*, the fact would identify its date. For isolated events the finger dwells long enough on the key to be sure of cutting off some portion of one of the indented lines. The dates susceptible of impression with advantage on the *automatic clock register* are such as the phases of an eclipse or occultation, or the bisections of a star or comet, or of a planet's centre or limb, by the wires of a transit instrument. The association of the nerves and sensations of sight and touch is known to be far more intimate than that of those of the eye and ear. The art of tapping at the proper dates requires far less practice and experience than that of counting beats and estimating fractions of a second. The labour of counting beats and of writing down the dates being here dispensed with, the equatoreal intervals of the transit wires may be reduced to two seconds of time, or even to less, and fifty bisections may now be registered in the same time as seven are in the ordinary way. The three advantages of Mr. Walker's method are respectively,—

"1st. The facility of acquirement of the practical skill for observing.

"2d. The *twofold* precision nearly of a single observation.

"3d. The *sevenfold* multiplication of observations in the same interval of time, or in the single transit of one, or the relative transits of two or more heavenly bodies.

"From all these sources it will be apparent that Mr. Walker's method of printing dates has nearly a *tenfold* advantage over the ordinary mode of using the transit instrument.

"A single transit of a star, or a night's or even a year's work by this method of printing, may take the place of some *ten* times those quantities by the method now in use.

"The experiment of printing the dates of bisections of transit wires by a star, on the ordinary registering fillet of Morse's telegraph, was made by Mr. Walker in 1846. It was repeated this last summer for some twenty or more stars, in connexion with Prof. Bond and Prof. Loomis, for a distance of some three hundred miles from Cambridge to New York. In October last, it was repeated for a like number of stars between Philadelphia and Cincinnati, in connexion with Prof. Kendall and Prof. Mitchell, through a distance of seven hundred and fifty miles. The taps made on the telegraph key at the time of bisection at each place were registered at both. In these operations, however, the ear was used to estimate fractions of a second by the *audible* beats of the telegraph and observing clocks, and no use was made of the *visible* register.

"Dr. Locke's electro-magnetic clock of his own invention and construction (Wheatston's method not being known to him at the time) was used for some two hours or more, on the 17th of November last, to make the *automatic clock register* such as is described above. The distance tried was about four hundred miles from Cincinnati to Pittsburg.

"The experiment was completely successful. The interruption of the line from Pittsburg to Philadelphia that night prevented the actual continuation of the two operations on the same fillet of paper, namely, the graduation of the paper by the automatic clock, and the reciprocal imprinting of the dates of transits of stars at the two observatories. Each process, however, has been tried by itself to a sufficient extent by Mr. Walker and his associates, to warrant his conclusions with respect to their combination, for a more full trial of which he now waits for the construction of the most approved apparatus.

"In order to make the precision of the other appendages of a transit instrument commensurate with the *tenfold* increase of that of the art of imprinting the dates of bisections for a single culmination, Mr. Walker recommends the use of a cast-iron box for the frame.

"Each side should carry three or more levels.

"The number read on each occasion should depend upon the degree of precision aimed at. The instrument should admit of rapid reversal, even on equatoreal stars. For use at the station of the Coast Survey, Mr. Walker prefers to retain the micrometer adjustment of the azimuth, like that of the new Simms' transit instruments recently made for the survey.

"In the telegraph operations for longitude, two such transit instruments of moderate size are to be mounted, at any two stations, distant one or more thousand miles. All the levels are to be read with the instrument pointing to the zenith, then twenty bisections of a circum-zenith star, are to be imprinted on the *automatic clock register* previous to reversal. The like number for the same star on the same wires are to be imprinted after reversal, and the levels are again to be read.

"A similar operation is performed for the transit of the same star at the western station.

"The primitive astronomical clock may be located and rated at the central station of the Coast Survey. The *automatic clock register* may be made and kept there, even if the distance be a thousand miles from either station.

"Clock registers in any number may be made at the separate stations. The transits of two fundamental stars at remote dates, at either of the three stations, may give the rate of the primitive or central clock.

"One such transit of the same star over each station with twenty printed registers of normal bisections, and six normal levellings, with independent levels, at or near the position of actual observation, with the increased precision of the instrumental adjustments, will give in the form of a permanent printed record (with multiplied copies) the relative longitude of the two stations.

"The uncertainty of such a result need be only a few hundredths of a second, and may be such only as attends our present knowledge of the relative longitudes of Greenwich and Paris, the two oldest observatories extant.

"I avail myself of the occasion to remark, that the Coast Survey operations were completely successful this autumn between Philadelphia and Cincinnati, while actually working on the line from Philadelphia to Louisville. The distance of the line in the air is nine hundred miles, that of the circuit is eighteen hundred. I learn from an authentic source that the same success attends the use of the line from Philadelphia to the Mississippi river opposite St. Louis. The length of this circuit is *one-tenth* of the circumference of the earth. The inference from this trial is clear, that a line round the earth, if such could be constructed, might be worked with facility at one stroke. The expense of acids to supply the thousand Groves' pint cups, required for the motive power, would be about one pound sterling (five dollars) per day."

ERRATA.

At p. 61, paragraph 5, substitute as follows:—"General Hodgson was appointed Surveyor-General of India in May 1821, by Lord Hastings when Governor-General, but not confirmed by the Directors, who considered the patronage to be in their hands. In lieu of this, he was appointed Revenue Surveyor-General. In 1826, he was appointed Surveyor-General, and held that office till 1827, when grief for the loss of his beloved wife induced him to resign and to return to England."

P. 28, Liverpool Observations of Encke's Comet,
Oct. 10, *for* $15^h\ 15^m\ 59^s$ G.M.T., *read* $15^h\ 15^m\ 57^s$
$+36^s{\cdot}80$ Corr. Eph. $+36^s{\cdot}91$

P. 29 *et seq.*, Mr. Lassell's machine is a *polishing*, not a *grinding* machine.

P. 46, March 26, *for* 29^h, *read* 20^h.

P. 47, Dec. 21, 2d Observation, *for* $-0^s{\cdot}23$, *read* $-0^s{\cdot}83$
Dec. 23, 2d — $-1{\cdot}00$, $-1{\cdot}10$
Jan. 15, dele the first four lines which are repeated;
towards the bottom, *for* five transits, *read* six.

P. 48, line 7, *for* six, *read* two; and *for* Jan. 11, *read* Jan. 15.

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